

## Claims

1. An electromagnetic solenoid coil comprising:

5 a simulated pole piece forming an inner core, said simulated pole piece further comprising coolant feed ports;

a perforated bobbin surrounding said simulated pole piece; and

duplex wound solenoid coil wires;

10 wherein coolant is supplied to said simulated pole piece, said coolant traveling through said coolant feed ports, through said perforated bobbin, and through and around said duplex wound solenoid coil wires; and further

wherein said duplex wound solenoid coil wires provide connected porosity that permits said coolant to flow radially from an inside diameter of said coil to an outside diameter of said coil.

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2. The electromagnetic solenoid coil according to claim 1, wherein said coolant is a liquid.

3. The electromagnetic solenoid coil according to claim 1, wherein said coolant is a  
20 gas.

4. The electromagnetic solenoid coil according to claim 3, wherein said coolant is selected from the group consisting of argon, nitrogen, carbon dioxide and air.

5. The electromagnetic solenoid coil according to claim 3, wherein said coolant is selected from the group consisting of chlorine and fluorine.

5 6. The electromagnetic solenoid coil according to claim 2, wherein said coolant is selected from the group consisting of ethylene glycol, water and hydrocarbon fuels and oils.

7. The electromagnetic solenoid coil according to claim 1, wherein said perforations  
10 in said bobbin are cross-drilled.

8. The electromagnetic solenoid coil according to claim 1, wherein said solenoid coil wires comprise a winding of three or more wires.

15 9. An electromagnetic solenoid coil comprising:  
a simulated pole piece forming an inner core, said simulated pole piece further comprising coolant feed ports;  
a perforated bobbin surrounding said simulated pole piece; and  
two or more lengths of electromagnetic coil wire, said lengths wrapped around  
20 each other in a helical manner;  
wherein coolant is supplied to said simulated pole piece, said coolant traveling through said coolant feed ports, through said perforated bobbin, and through and around said electromagnetic coil wire; and further

wherein said electromagnetic coil wire provides connected porosity that permits said coolant to flow radially from an inside diameter of said coil to an outside diameter of said coil.

5     10.     The electromagnetic solenoid coil according to claim 9, further comprising a supply manifold, said supply manifold supplying coolant to said electromagnetic coil wire.

11.     The electromagnetic solenoid coil according to claim 10, further comprising a  
10     supply plenum, said supply plenum in communication with said supply manifold.

12.     The electromagnetic solenoid coil according to claim 9, further comprising a receiver manifold, said receiver manifold positioned around said outside diameter of said coil, said receiver manifold receiving said coolant when said coolant exits said coil.

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13.     The electromagnetic solenoid coil according to claim 12, further comprising a receiver plenum, said receiver plenum in communication with said receiver manifold.

14.     An electromagnetic solenoid coil cooling system comprising:  
20     a simulated pole piece forming an inner core, said simulated pole piece further comprising coolant feed ports;  
       a perforated bobbin surrounding said simulated pole piece;  
       duplex wound solenoid coil wires;

a reservoir to hold a coolant; and

a pump;

wherein said pump removes coolant from said reservoir and supplies said coolant to said simulated pole piece, said coolant traveling through said coolant feed ports,

5 through said perforated bobbin, and through and around said duplex wound solenoid coil wires; and further

wherein said duplex wound solenoid coil wires provide connected porosity that permits said coolant to flow radially from an inside diameter of said coil to an outside diameter of said coil; and further

10 wherein said coolant, upon exiting said coil, is routed to a heat exchanger, and upon exiting said heat exchanger, is routed back to said reservoir.

15 15. The electromagnetic solenoid coil cooling system according to claim 14, further comprising a supply manifold and a supply plenum, said supply manifold and said supply plenum supplying coolant to said inner core.

16. The electromagnetic solenoid coil cooling system according to claim 14, further comprising a receiver manifold and a receiver plenum, said receiver manifold and said receiver plenum surrounding said solenoid coil wires.